Chapter 13

Face and Neck

Disorders of the Upper Airway

- Choanal atresia
  - Congenital obstruction of the posterior nasal choana
  - Can be bony or membranous
  - Involvement
    - Unilateral: mild respiratory symptoms
    - Bilateral: intermittent respiratory distress in infants (obligate nasal breathers)
  - Diagnosis
    - Inability to pass a nasal catheter into the pharynx
    - Use computed tomography (CT) scan
    - Perform direct nasopharyngoscopy
  - Initial management
    - Insert an oropharyngeal airway
    - Administer orogastric tube feeds
- Intraoral obstruction
  - Mandibular hypoplasia (micrognathia)
    - Associated with Pierre Robin syndrome and Treacher Collins syndrome
    - A normal-sized tongue falls posteriorly, obstructing the supraglottic airway
    - Treatment: placing patient in a prone position is usually all that is required; nasopharyngeal tube is rarely needed
    - The mandible grows faster in children, so by 3 months of age, the condition is usually resolved
  - Macroglossia
    - Associated with Beckwith-Wiedemann syndrome
    - Treatment
      - Place patient in the prone position to keep tongue forward
      - Tracheostomy and gastrostomy tube may be necessary

- Intraoral neoplasms
  - Types: lymphangiomas, teratomas, aberrant thyroids, rhabdomyosarcomas
  - Treatment approaches vary
- Laryngeal obstructions
  - Malformations
    - Laryngomalacia: anatomic malformation of the supraglottic larynx, resulting in collapse of supraglottic structures on inspiration (the vocal cords, subglottic larynx, and trachea are normal)
      - This is the most common obstructing lesion of the infant airway
      - Symptoms include inspiratory stridor, but not cyanosis
      - May not be present for days to weeks
      - Worsens with agitation and supine positioning
      - Milder when patient is in prone position with neck extended
      - Diagnose with lateral neck radiograph or direct laryngoscopy (will reveal Ω-shaped epiglottis)
      - Treatment is usually nonsurgical; place infant in prone position with neck extended
      - Temporary tracheotomy may be required for severe symptoms
      - Symptoms will resolve by 2 or 3 years of age
    - Clefts: incomplete separation of trachea and esophagus, associated with esophageal atresia
      - Symptoms: respiratory distress, cyanosis, and aspiration pneumonia
      - Diagnosis: endoscopy
      - Treatment: endotracheal (ET) intubation and gastrostomy tube, later surgical reconstruction
    - Webs: thin, membranous, obstructing diaphragms usually located at the glottic level
      - Symptoms: airway obstruction at birth
      - Diagnosis: laryngoscopy
      - Treatment: endoscopic excision
    - Atresia: requires immediate tracheostomy
    - Foreign bodies

- Symptoms: sudden choking, loss of voice, dyspnea, inspiratory stridor, retractions
- Initial treatment: modified Heimlich maneuver
- Surgical treatment: removal by direct laryngoscopy

- Cysts and tumors
  - Laryngocele: fluid-filled cyst of the larynx
    - Symptoms: inspiratory stridor
    - Diagnosis: laryngoscopy
    - Treatment: ET intubation and needle aspiration of the cyst, surgical unroofing
  - Lymphangioma
    - Pathology: usually multiloculated and lined with endothelium
    - Symptoms: airway obstruction
    - Treatment: staged excision
  - Hemangioma
    - Usually seen in infants < 1 year old
    - Subglottic location
    - Often associated with cutaneous hemangiomas
    - Symptoms: inspiratory stridor
    - Diagnosis: laryngoscopy
    - Treatment: may regress spontaneously; administer steroids (if symptomatic)
  - Papillomas: benign neoplastic lesions associated with condyloma acuminatum in mother at the time of birth
    - Symptoms: hoarseness, stridor, dyspnea
    - Treatment: surgical excision
- Acquired obstructions
  - Acute epiglottitis (supraglottitis): acute inflammatory swelling of the epiglottis, caused by *Haemophilus influenzae* type b
    - Occurs in children ages 2–6 years old
    - Symptoms: inspiratory stridor, "sniffing" head position, systemic illness, drooling, dyspnea, muffled voice; patients appear toxic with fever, tachycardia, tachypnea, and increased white blood cell count
    - Diagnosis: radiograph of the lateral neck; **never attempt to visualize the throat in the emergency department**

- Treatment: ET intubation (usually for 3 days) in an operating room under general anesthesia with a surgeon present; tracheostomy if necessary (rare); intravenous antibiotics (cefotaxime or ceftriaxone)

- Croup (acute laryngotracheobronchitis): viral inflammation producing subglottic edema, caused by parainfluenza viruses A and B
  - Pathology: subglottic edema
  - Occurs in children ages 3 months to 3 years old
  - Symptoms: barking cough, inspiratory and expiratory stridor, substernal retractions, no drooling
  - Laboratory findings show increased white blood cell count with right shift of differential (ie, lymphocytosis)
  - Diagnosis: neck radiographs show subglottic narrowing
  - Treatment: humidification (croup tent) and racemic epinephrine (occasionally dexamethasone for severe cases)
- Foreign bodies
  - The most common site affected is the right mainstem bronchus
  - Symptoms: stridor, aphonia, cyanosis, hypoxia, coughing, wheezing, fever, rhonchi
  - Diagnosis: anterior-posterior and decubitus chest radiographs with nonobstructed side down; radiograph will show hyperaeration on the side with obstruction due to air trapping
  - First aid: Heimlich maneuver, cricothyroidotomy, oxygen
  - Surgical treatment: extraction using rigid bronchoscopy under general anesthesia
- Postintubation subglottic tracheal stenosis: cricoid forms the only complete ring in the airway and the area of smallest tracheal diameter; stenosis usually occurs at the level of the ET tube balloon cuff
  - Diagnosis: laryngoscopy
  - Prevention: ensure there is a small air leak around the ET tube, stabilize ET tubes, and avoid reintubations

Surgical Procedures for Procuring an Emergency Airway

- Cricothyroidotomy (avoid in children < 10 y old)
- Tracheostomy
  - Avoid in an emergency setting
  - Never excise cartilage from the anterior tracheal wall
  - Make longitudinal tracheal incisions through the second and third rings
- Laryngoscopy
  - Most common indication is inspiratory stridor
  - Unique anatomical features of the infant larynx to note before performing laryngoscopy:
    - Infant larynx is situated more anteriorly at birth
    - It is the narrowest in the subglottic region
  - Indications
    - Laryngomalacia
    - Subglottic hemangiomas, papillomas, webs, foreign bodies, cysts
    - Most common complication is laryngeal edema; treat with humidification, racemic epinephrine, and steroids
- Bronchoscopy (flexible or rigid)
  - Diagnostic uses
    - Tracheomalacia and stenosis
    - Extrinsic compression
    - Tracheobronchial lavage (in cystic fibrosis patients)
    - Foreign body retrieval (rigid bronchoscopy)
- Establishing an airway
  - Rapid sequence intubation: etomidate plus succinylcholine (except in burns or crush injuries)
  - In patients < 10 years old, perform a tracheostomy through the second tracheal ring instead of cricothyroidotomy
  - ET tube size (estimate): (16 + age in years)/4, or approximately the size of the child's little finger
  - Distance (in centimeters) from lips to midtrachea: 12 + (age in years/2)

Trauma

- Airway issues
  - Fractures of the mandible (particularly subcondylar

fractures) or maxilla (Le Fort fractures) can result in free-floating bone or soft tissue, which can prolapse and obstruct the airway
    - Dislocated teeth or debris can obstruct the airway
    - Initial maneuvers to secure an airway may include jaw thrust, nasal trumpet (**do not use** if a fracture at the base of the skull is suspected), or oral airway
- Managing facial bone fractures
    - In the absence of fractures leading to airway obstruction or severe bleeding, facial bone fractures do not need to be managed acutely, but can be addressed up to 2 weeks after injury
    - Mandibular fractures can result in free-floating segments, causing tongue prolapse and airway obstruction
        - If this occurs, the mandible can be maneuvered anteriorly to allow airway management and fractures can be addressed later
        - Presenting symptoms include pain upon jaw opening, inability to open jaw (trismus due to masseter muscle spasm), and malocclusion (top and bottom teeth do not match up correctly)
        - Most mandibular fractures involve more than one site; isolated fractures are uncommon
        - Many mandibular fractures are of the greenstick (incomplete) type and can be managed conservatively by closed reduction
        - Subcondylar fractures are generally managed with a soft diet and close observation
        - Nongreenstick body, angle, ramus, and parasymphysis fractures are managed with open reduction and internal fixation, along with mandibular maxillary fixation via intraoral wiring
        - Care must be taken to avoid injuring permanent tooth roots when placing screws
        - When wiring the jaws together, consider possible airway obstruction, emesis, and suitable caloric intake; wire cutters should be available at the bedside at all times
    - Maxillofacial fractures
        - Le Fort classification (these fractures can wait up to 2

weeks for repair and are **not** urgent once bleeding is controlled and the airway is stable)
        - Le Fort I: maxillary and alveolar fracture
        - Le Fort II: pyramidal, nasal, and orbital fracture
        - Le Fort III: craniofacial disassociation
    - Presenting symptoms: distorted facial appearance, facial swelling or bruising, malocclusion, diplopia
    - Significant hemorrhage often accompanies fractures of the maxilla; it can be managed with nasal and oral packing **after** the airway has been secured
    - May be accompanied by cervical spine trauma and orbital or ocular trauma
    - Use caution when considering placing nasal tubes (eg, nasogastric tubes, nasal trumpets) in patients with nasal or maxillary fractures because of the possible presence of a basilar skull fracture; this can result in inadvertent placement into the brain
    - Assess the hard palate for fracture by palpation
    - Management is limited to the facial support buttresses (medial and lateral), which are repaired with open reduction and internal fixation, and possible mandibular maxillary fixation (temporary, short term)
  - Nasal fractures
    - Most common facial fractures of the face, but the least important
    - The decision to repair is based upon cosmetic considerations and is not urgent (can be delayed 10–14 days)
    - Septal hematoma
      - May be associated with a fractured nasal septum
      - Treatment: incision and evacuation of the clot; suture the mucoperichondrial flap in place over bolsters; administer antibiotics
- Base of the skull and temporal bone fractures
  - Presenting symptoms
    - Postauricular bruising (Battle's sign)
    - Orbital bruising (raccoon eyes)
    - Auditory deficits
    - Facial nerve injury
    - Hemotympanum

        - Cerebrospinal fluid otorrhea or rhinorrhea
    - If facial nerve function is absent, determining and documenting the time frame (ie, delayed versus immediate) is important to optimize future facial nerve function; complete immediate-onset nerve damage requires direct nerve repair once life-threatening injuries have been addressed
        - Managing incomplete facial nerve injuries (ie, some movement is visible) is not of acute interest and management can be delayed for up to 2 weeks
        - Facial nerve repair, when indicated, is performed after decompression and under magnification with 9-0 suture
    - Hearing loss can be conductive (mechanical) or sensorineural (nerve) and is distinguished using a tuning fork
    - Treat tympanic membrane perforation by keeping the ear clean and dry
    - Cerebrospinal fluid leak often presents with a clear, salty-tasting drainage that is exacerbated by sitting upright and leaning forward
        - Drainage should be stopped with pressure or packing and broad-spectrum antibiotics to limit the possibility of meningitis
        - Repair can be deferred until appropriate otolaryngological or neurosurgical expertise is available
- Laryngeal trauma
    - Uncommon in pediatric patients because of the elevated position of the larynx underneath the mandible and the cartilaginous structure of the pediatric larynx (which is commonly ossified in adults)
    - Presenting symptoms
        - Hoarseness
        - Stridor
        - Crepitation and subcutaneous emphysema
    - Acute management consists only of appropriately securing the airway
    - Definitive management can then be performed by the appropriate specialists
- Penetrating neck trauma: hemorrhage and airway injury are

the primary concerns
- The neck is divided into three anatomic zones to aid in management:
  - Zone 1
    - Boundaries: clavicle to cricoid membrane
    - Critical structures: common carotid artery, subclavian artery, apices of the lung, and the brachial plexus
  - Zone 2
    - Boundaries: cricoid to angle of the mandible
    - Critical structures: common and internal carotid arteries, internal jugular vein, esophagus, and trachea
  - Zone 3
    - Boundaries: angle of mandible to base of the skull
    - Critical structures: internal carotid artery, jugular vein
- If the platysma muscle is not transgressed, no surgical management is initially indicated, and close observation is warranted
- Diagnostic measures
  - Esophagoscopy
  - Bronchoscopy
  - Contrast swallow
  - CT angiogram
- Zone 1 and 3 injuries
  - Management is selective based on clinical evidence of significant structural injury, such as significant bleeding, expanding hematoma, subcutaneous emphysema, hoarseness or stridor, hemoptysis, decreased pulses in the arm or neck, or mental status changes
  - If the above are present, exploration with the appropriate expert (ie, vascular surgeon, otolaryngologist, neurosurgeon) is indicated to manage injury of involved structures
- Zone 2 injuries
  - Presenting symptoms
    - Air bubbling from the wound
    - Subcutaneous emphysema
    - Stridor

        - Dyspnea
        - Hypoxia
    - Management includes initial neck exploration to evaluate vascular structures, trachea, and the esophagus; repair as indicated
    - Tracheal injury: after the airway is secured, repair can be performed with 5-0, 6-0 nylon sutures, being careful not to enter the lumen of the trachea (if the airway is secure, evacuation to a suitable expert is strongly encouraged)
  - Esophageal injury may be difficult to diagnose because of delayed presentation, but should be considered in patients with unexplained fever or tachycardia and penetrating neck trauma in Zone 1 or 2
    - Presenting symptoms include fever, tachycardia, and dysphagia
    - Diagnosis: chest radiograph, esophagoscopy, diatrizoate meglumine and diatrizoate sodium solution swallow
    - Initial management: nothing by mouth, exploration and drainage, antibiotics, and referral if necessary to the appropriate surgical specialty (general surgery, thoracic surgery, etc)
    - Definitive management: debridement with primary repair and feeding tube placement

Masses

- Cervical lymphadenitis
  - Most common cause of a neck mass in a child
  - Etiology: usually *Staphylococcus* or *Streptococcus*
  - Treatment
    - Initial: antibiotics (eg, third-generation cephalosporin) to treat the primary cause (otitis media, pharyngitis)
    - Incision and drainage of fluctuant nodes
    - Excision for chronic lymphadenitis
    - Differential diagnosis includes tuberculosis, atypical mycobacteria, and cat-scratch fever (*Bartonella henselae*)
- Lymphoma
  - Most common malignant neoplasms of the head and neck
  - Firm, fixed nodes with generalized involvement (especially

if present in the neck, axilla, or groin)
  - Diagnosis: excisional lymph node biopsy
- Thyroglossal duct cyst
  - Etiology
    - Development of the thyroid gland originates at the base of the tongue in the foramen cecum and passes between the genioglossus muscles and through the hyoid bone to its normal anatomic position
    - Most common congenital lesion of the neck
  - Symptoms
    - Usually discovered at 2–4 years of age, when baby fat starts to diminish
    - Usually asymptomatic, but recurrent infection is a characteristic problem due to communication with the pharynx
  - Physical
    - Located in the midline at or below the level of the hyoid bone
    - Moves up and down with swallowing
    - Differential diagnosis: lymphadenopathy, dermoid cyst, thyroid gland (obtain thyroid scan if any question exists regarding the presence of a normal thyroid gland)
  - Treatment
    - Antibiotics for infection
    - Needle aspiration of abscesses
    - Elective surgical excision of the cyst and tract to the pharynx, in continuity with the central portion of the hyoid bone (Sistrunk operation), and ligation of the foramen cecum
- Branchial cleft cysts
  - Congenital fistula resulting from malformation or persistence of the second (most common) or third branchial cleft; abnormalities of the first brachial arch are associated with facial clefts (eg, cleft palate)
  - First branchial cleft sinuses communicate with the eustachian tube
  - Second branchial cleft cysts extend from the anterior border of the lower third of the sternocleidomastoid muscle

superiorly, then inward between the carotid bifurcation, entering the posterolateral pharynx just below the tonsillar fossa
    - The third branchial cleft tracts lateral to the carotid bifurcation
    - Symptoms
        - Painless nodule at anterior border of the sternocleidomastoid
        - Drainage from external auditory canal (third cleft sinus)
        - External fistula with drainage of clear fluid from the lateral neck (second cleft)
        - Abscess formation in the lateral neck
    - Pathology: lined with squamous and columnar epithelium, cartilaginous remnants, and cystic dilatations
    - Treatment of second branchial cleft anomalies
        - Initial: treat infection (if present) with antibiotics to cover *Staphylococcus* and *Streptococcus*
        - Perform complete surgical excision of the cyst and tract
            - A lacrimal duct probe inserted through the external opening, as well as injection of methylene blue, will help define and facilitate dissection of the tract
            - Use a series of small, transverse, "stair step" incisions, rather than a long, oblique incision
            - The marginal branch of the facial nerve may be injured by intraoperative retraction
- Cystic hygroma (lymphangioma)
    - Etiology
        - Congenital malformation resulting in sequestration or obstruction of developing lymphatic channels
        - Usually posterior to the sternocleidomastoid muscle of the neck (posterior triangle)
        - Other sites include:
            - Axilla
            - Groin
            - Mediastinum
            - Retroperitoneum
    - Cysts are usually multiple, may "infiltrate" deep structures of the neck (tongue, mouth floor), and are lined by endothelium
    - Infected cysts may cause airway compromise by compressing

the trachea
    - May contain nests of vascular tissue (benign lesions)
- Physical characteristics
    - Soft and compressible
    - Transilluminate
    - Usually apparent at birth, sudden enlargement later may be due to hemorrhage into the lesion
- Diagnosis: ultrasound, chest radiograph, CT scan
- Complications
    - Airway compromise
    - Disfigurement
    - Hemorrhage into the cyst may cause a purplish discoloration
    - Infection (*Staphylococcus* or *Streptococcus*) may cause rapid enlargement and airway compression
- Treatment
    - Conservative surgical resection
        - Rarely complete because the lesion is usually multilocular and there is no well-defined cleavage plane between the lesion and normal tissue
        - May require repeated partial excisions with preservation of all adjacent critical structures
        - Wound is drained postoperatively by closed suction
        - Needle aspiration of accumulated fluid may be required postoperatively
    - Injury to the facial nerve (cranial nerve VII) must be avoided
    - Injection of sclerosing agents (eg, OK-432, which is derived from group A *Streptococcus pyogenes*) may yield good results in cases with primarily macrocystic disease; sclerotherapy may also be used in conjunction with operative excision before and after the operation

Miscellaneous Conditions

- Congenital wryneck (torticollis)
    - Evident in early months of life due to fibrosis of the sternocleidomastoid muscle
    - Physical examination reveals tender, palpable swelling in

lower part of the sternocleidomastoid, head rotated toward the opposite side of the mass
    - Treatment
        - Perform neck radiograph to exclude vertebral anomalies (Klippel-Feil syndrome)
        - Active and passive stretching exercises
        - Surgical transection of the belly of the sternocleidomastoid muscle if above is unsuccessful (rarely necessary)
    - 20% will have associated hip dysplasia
- Epiglottitis
    - Age group: 3–6 years old
    - Etiology: *Haemophilus influenzae B*
    - Symptoms
        - High fever
        - Inspiratory stridor
        - Drooling
        - Head in sniffing position
        - Cherry red epiglottis
    - Diagnosis
        - Lateral neck radiograph shows edema (evident with "thumbprinting") of the epiglottis
        - If epiglottitis is suspected, **never** attempt direct examination of the throat, except in the operating room
    - Treatment
        - Intubation in the operating room, under general anesthesia, by the most experienced airway endoscopist available; a surgeon should be present, scrubbed, and prepared to perform an emergency tracheostomy if necessary
        - Give antibiotics
- Epistaxis
    - If anterior vessel is the source, it can usually be treated by pinching the nasal ala for several minutes
    - Apply hemostatic packing or tamponade using a balloon device if bleeding persists